



Aluminum and Cadmium Exposure March 25, 2008

A resident of Cumming, GA contacted the Chemical Hazards Program (CHP) regarding her concerns about higher than normal levels of aluminum and cadmium in her hair. She stated that she began worrying about a potential decline in her mental state and cognitive functions since fall 2007. In November 2007, she obtained a hair analysis that showed elevated levels of aluminum (4.38%) along with slightly elevated levels of cadmium (0.06%). Subsequently, she contacted our program to ask whether we could ascertain a potential source of aluminum that she may be exposed to, and whether elevated levels of aluminum in her body might be responsible for her declining mental and cognitive state, or the shakiness she sometimes experienced.

Since aluminum is ubiquitous in the environment, the general population will be exposed to aluminum by inhalation of ambient air and the ingestion of food and water. Average daily intakes of 8-9 mg/day for adult men and women have been reported, based on an FDA Total Diet Study. Food additives containing aluminum, including preservatives, coloring agents, anti-caking agents, and leavening agents are the major dietary sources of aluminum in the United States.

The major contributors to aluminum in the diet are grains (24-49%), dairy products (17-36%), desserts (9-26%), and beverages (5-10%). For example, cheese from a frozen pizza was reported to contain up to 14 mg of aluminum from basic sodium aluminum phosphate. Up to 1.5 mg were found in single serving packets of nondairy creamer containing sodium aluminosilicate. Products such as baking powder and pancake mixes contained up to 180 mg of aluminum per serving.

The consumption of aluminum in foods is low compared to the amount of aluminum consumed when taking aluminum-containing medication, such as antacids, buffered aspirins, anti-diarrheal agents, and certain anti-ulcer drugs at their recommended doses. Antacids and buffered aspirin, which are often taken in multiple daily doses for prolonged periods, contain 4-562 mg/kg of aluminum. Buffered aspirin may contain 10-20 mg of aluminum per tablet. Many antacids contain 300-600 mg of aluminum hydroxide per tablet/capsule. When large

oral loads of aluminum (1,000-4,000) mg/day) in the form of antacids are ingested some of the excess aluminum is absorbed, which is usually <1% of the intake amount in healthy individuals.

According to the resident's dietary habits, which included filtered water, a grain tonic, and salmon once a week, she was probably consuming a normal amount of aluminum in her diet. She stated that she did not use aluminum cookware in her home, did not take antacids regularly, and did not use buffered aspirin on a regular basis (all known sources of aluminum exposure). We therefore could not pinpoint a source of elevated aluminum in her living environment. In the past she may have been exposed to a significant source of aluminum. Her hair analysis reveals that aluminum is still being shed from her body.

After reviewing the Agency for Toxicological Substances and Disease Registry (ATSDR) Toxicology Profile for Aluminum, the lowest observable adverse health effects level (LOAEL) for chronic daily intake of aluminum (greater than one year) of 100 milligrams/kilogram of body weight per day in mice was established with neurological effects as the endpoint. The neurological endpoint used in this determination was for decreased forelimb and hindlimb grip strength and decreased temperature sensitivity. If this dose is extrapolated to a man weighing 70 kg, the chronic daily intake of 7,000 mg of aluminum per day (or 7 grams per day) would have to be ingested.

As mentioned above, aluminum exposure could not be determined, aside from everyday dietary exposure. It is not likely that the resident was exposed to levels as high as the LOAEL unless she was in an occupational environment that involved the production or processing of aluminum containing compounds. Furthermore, there was no information to correlate oral or inhalation exposure to the shedding of aluminum in the hair.